Automobile Headlighting

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In the following, no attempt is made to give a complete discussion of this subject, but rather several interesting phases are taken up. For a fuller treatment reference is made to Circular No. 8 of the Engineering Experiment Station, copies of which may be obtained without cost from the Department of Electrical Engineering, Robinson Laboratory.

In the beginning automobile headlights were the same oil burners with small reflectors that were in use on the horse-drawn vehicles of the day, but increasing speed soon made these inadequate and they were succeeded by the acetylene burners with improved reflectors. Then came the electric lamps with the relatively high grade parabolic reflectors of the present day.

By this time, however, the glare had become intolerable for the driver or pedestrian who was so unfortunate as to face the ever brightening lights and thus the facility with which the electric current could be reduced lead to the makeshift practice of dimming. It has been shown by Dr. Prentice Reeves that, while the eye, when adapted to a low brightness will accustom itself fairly well to a bright light in three seconds, it requires more than twenty times as long to correspondingly change its adaption from light to dark. This indicates the essentially unscientific character of the dimming custom. Mr. A. W. Devine, who has made an extensive study of headlighting in Massachusetts, states that during parts of 1921, while seven accidents were due to dazzling lights, 22 were due to insufficient illumination. In 1920 the corresponding figures were 8 and 13.

In June, 1915, an application for a patent on a combination of vertical and horizontal prisms in a headlight lens was made by E. L. Clark of Cleveland. Thus began the effort by bending down the rays which would otherwise produce glare, to effectively apply the light of the lamps to the road surface, where it is needed. At the same time the beam is spread out so as to adequately light up the edge of the roadway. It is interesting to note that this patent, though applied for in 1913, was not issued till June 1920, so that it still has nearly its whole life to run. It seems to be a broad patent and under it about seven of the larger lens manufacturers are at present licensed. It will be interesting to watch the effect of this patent upon the headlight lens business, as there are more than thirty companies now making headlight lenses.

There is an unlimited variety to the distributions of light that can be obtained through modification of the light from the parabolic reflector; nor is it possible to say that any one distribution is the best one for all drivers and for all roads. The speedy driver naturally is more interested in a strong light far ahead than is the man whose maximum is twenty-five miles. Such a light is also more important for straight roads than for winding roads, where a wide spread is particularly desirable. Again a light far ahead is of little use when the road is so poor that one must pick his way among the holes. The old saying that "you can't eat your cake and have it too," applies with much force to headlighting, though this fact is often overlooked by would-be inventors. There is only just so much light to dispose of and if it is used in one place, it can not be used in another. For the average driver and for all-round driving, the best distribution is probably one which lights up the whole width of the road for a range from 50 to 250 feet ahead of the car, but of course with the light spread over such an extended area, it will be impossible to get as high a candle-power at any one point as will be obtained from a carefully focused lamp in an unmodified parabolic reflector, where all the light is concentrated upon a small spot.

Very few of the lenses on the market have been scientifically designed and it would seem probable that most of them must eventually give place to a few carefully selected models, designed to give the various distributions actually needed.

It may, however, well be doubted whether the deflecting lens will hold its important place in the headlighting field for many years. The use of the lens is based upon the almost universally used parabolic reflector, because that reflector, throwing a conical beam of light, will not, unmodified, give the best road lighting. It is, however, perfectly possible to slightly change the shape of the reflector so that it gives the desired distribution directly without need for any modifying lens. Several such reflectors may now be purchased, but their cost is still much higher than that of the best lenses. When, however, they come to be made in large quantities, it is evident that the cost of stamping the irregular shape need be very little more than that in the case of the paraboloid.

The headlighting problem has proved very attractive to the amateur inventor and many devices of the classes known as deflectors have been submitted to the Engineering Experiment Station for approval. These are nearly all based upon the same principal as the "Ford Green Visor" and the home-painted glass, that is cutting off the direct rays from either the upper or the lower half of the reflectors. In most cases nearly or quite half the light is absorbed and wasted by such devices, though in some it is diffusely reflected or transmitted and thus made useful to some extent. However, such devices have not found general favor, as indicated by the fact that of 250 cars recently examined, while parked on or near the Campus, less than 2 per cent had such equipment, about 60 per cent had lenses and 30 per cent painted glass, including the Fords. Less than 8 per cent were clear glass.

The approval of devices submitted is based upon a laboratory test of the light distribution made with a portable photometer. The required distribution is based upon specifications drawn up by a committee of the Illuminating Engineering Society and which have also been checked by committees of the Society of Automotive Engineers and the National Traffic Association, and by various State Commissions. One feature of these regulations, that is not generally appreciated, is that they not only limit the permissible glare but also, that which is of equal importance, specify a minimum driving light upon the road.

Another matter which automobile users generally still fail to understand, is that no headlighting device will function properly unless it is properly adjusted, as to the position of the electric bulb and the tilt of the headlamp. Indeed, unless this adjustment is made, the light will often be thrown upward into the eyes of the approaching driver instead of downward onto the road.